

## WEATHER INFLUENCES.

*Weather Influences: an Empirical Study of the Mental and Physiological Effects of Definite Meteorological Conditions.* By Dr. E. G. Dexter. Pp. xxxi+286. (New York: The Macmillan Company; London: Macmillan and Co., Ltd.) Price 8s. 6d. net.

THE effect of changes of weather on human activities has been the subject of much discussion, and each of us has no doubt formed an opinion on how he individually is affected by different meteorological conditions. The problem as affecting the behaviour of humanity in the mass has, however, received but scant attention hitherto. The statistical method affords the means of obtaining numerical results which enable us to estimate the importance of such effects.

Meteorological statistics are nowadays available from most centres of population; social statistics are also plentiful, yet of these only a limited number can be made to yield information on the general conduct or the working capacity of the community as a whole. In the book before us Dr. Dexter has collected and discussed sixteen classes of data culled from school records, covering both questions of attendance and conduct, police records dealing with cases of assault, drunkenness, murder, suicide, arrests for insanity, discipline in penitentiaries and the health of the force, the death register, registers of attendance in the out-patient departments of hospitals, and records of the number of clerical errors discovered in the books of certain banking establishments. The latter are the only data studied which deal exclusively with mental activities. All the records refer to New York City or to Denver, Colorado. The meteorological statistics with which they have been compared were obtained from the U.S. Weather Bureau.

The effects of seasonal changes are first discussed, and then the influence of each of the meteorological elements is considered separately. The general method of arranging the material for this purpose will be clear from the following description of that of dealing with the connection between temperature and assault. The days falling within the period considered were arranged in groups according to their mean temperatures, each group extending over a range of 5° F. On the assumption that temperature has no effect on assault, the number of days in each group is proportional to the "expectancy" of assault for that group. The actual number of occurrences of assault on the days of the group is computed as a percentage of the "expectancy," and curves have been drawn using the "occurrences" as ordinates and temperatures as abscissæ.

In dealing with the element rainfall the usual meteorological distinction has been drawn between days of rainfall, on which 0.01 inch of rain or more was measured, and dry days. It seems a pity that a further subdivision was not made. Most of us would be inclined to draw a wide distinction between showery days with only a few hundredths of an inch of rainfall and days of steady downpour. Even if such a further subdivision had been adopted, days with a

few heavy showers would not be distinguishable from days of continuous fall; probably a classification on the basis of duration rather than amount of rainfall would yield results which would repay the labour involved in tabulating the records of self-registering rain gauges.

The majority of the curves show fluctuations which are greatly in excess of any which could be due merely to accidental variations. The number of data is in some cases extremely large (about 40,000 cases of assault), and there can be no doubt about the genuineness of the effects of meteorological changes.

The interpretation of the results is, however, a matter of considerable difficulty, and the possible influence of other than meteorological causes has to be steadily borne in mind. The general line of argument adopted regards the curves as compound functions of "irritability" or "emotional state" and "available" or "reserve energy." Thus, to return to the temperature-assault curve, we find a marked deficiency of occurrences at low temperatures. This has been taken to mean that under these conditions so large a portion of the vital energy is used up in supporting normal metabolic processes that the surplus available for active disorder is small. Under warmer conditions our pugilist, in addition to being more out of doors and thus seeing more of his neighbour, has more reserve energy available for active warfare, and the work of the police is proportionately increased. Above 65° the curve commences to rise with increased rapidity. Fighting energy is now at its prime, and at the same time "irritability" or quarrelsomeness is rapidly increasing. The temperature group 80°-85° shows a conspicuous maximum in the relative frequency of assaults. In the next group, 85°-90°, the curve exhibits a sudden drop. Irritability may very possibly be at a maximum, but the energy necessary to commence war is lacking, and a mere desire to fight is not a punishable offence. It is an interesting fact that the curve for women shows the above effects even more conspicuously than the one for men. A similar accentuation of the general characteristics is shown in all cases in which the number of data is sufficiently large to justify a separation of the sexes, so that it would appear that women are, on the whole, more susceptible to weather influences than men.

Some of the most interesting and at the same time most inexplicable curves are those which show the effect of the height of the barometer on human activities. With a few exceptions all classes of data show a marked excess of occurrences for periods of low barometer and a corresponding deficiency when readings are high. We cannot set this down to the direct effects of the diminution of pressure on the human organism; crime, &c., does not increase with altitude. Attempts at explanation by calling to our aid the usual accompaniments of a low barometer, viz. wind, rain, or cloud also fail, for when the effects of these elements are considered separately we find that in a number of cases the results contradict the hypothesis. Dr. Dexter directs attention to the peculiar "feel" which some people have for the approach of a storm, but this hardly amounts to an

explanation. It has been suggested that the radio-active emanation which is always present in the atmosphere in varying quantities may not be without influence on the human organism, and if, as Elster and Geitel suppose, this emanation is mainly derived from the underground air, which is more copiously discharged into the atmosphere as pressure decreases, it may be possible to establish a connection between the "storm feel" and the presence of radio-active emanation. If this be so we should expect to find the effect more pronounced with a falling than with a rising barometer, and, in the absence of direct measurements of the amount of emanation, the results obtained from a classification of the days, or perhaps better still, by a subdivision of the data used in constructing the present curves, on this principle would probably be interesting. Such a separation might prove profitable from a purely meteorological point of view, apart from all considerations of emanations, radio-active or otherwise. Possibly the peculiar abnormalities shown by most of the data for days of calm may be to some extent due to similar causes. The connection is, however, a very complicated one; attempts to trace a similarity between days of calm and days of low barometer fail signally.

We cannot here enter into a discussion of all the results or criticise the individual conclusions arrived at. In the final chapter Dr. Dexter further develops his thesis of the "available energy" and "emotional state" in the light of all the accumulated evidence, and comes to the conclusion that the effect of weather changes is greater on the former than on the latter, at any rate in its practical effects on conduct.

The study of the problems dealt with in the book is not without a certain practical interest to all who are responsible for the control of large numbers of individuals. If certain meteorological conditions can be shown to have a deleterious or beneficent influence on conduct or working capacity, it is well that we should recognise the fact as clearly as possible, and do what we can to mitigate the harmful conditions. Man cannot hope to control the weather, but he can modify the highly artificial conditions under which he lives to a very large extent.

#### A LIMNOLOGICAL MONOGRAPH.

*Le Leman, Monographie Limnologique.* By Prof. F. A. Forel. Vol. iii. Part ii. Pp. 410-715. (Lausanne: F. Rouge et Cie., 1904.)

IN the issue of this, the second part of his third volume, Prof. Forel completes his great monographic study of the Lake of Geneva. The veteran pioneer of scientific limnological research is to be congratulated on the successful termination of his monumental task, commenced some half-century ago.

The impetus which the study of lakes has received from the labours of Forel has now carried us so far that we find it difficult to realise the arduous nature of the work accomplished by him, who had in so many different directions to make the first tentative trials of methods of research with which all students of limnology are now familiar. The completed work is not merely a compendious study of the Lake of

Geneva, but is besides of the utmost value as a general study of the nature of fresh-water lakes. In his painstaking study of this one lake he has been so fortunate as to observe and explain in a satisfactory manner many phenomena of general scientific interest and importance, among others the mysterious rise and fall of the waters of the lakes now known as seiches, the peculiar abyssal fauna of the lake, &c.

The present part of the work, which is mainly historical, deals with such varied subjects that it is difficult to particularise. Nothing having the slightest connection, direct or indirect, with the Lake of Geneva is destitute of interest for Prof. Forel, and we find here discussed many questions which a less enthusiastic limnologist might have been content to leave to students of other departments of knowledge. He gives a *résumé* of the history of the surrounding countries, of legislation, the fluctuations of population, local traditions, &c. More particularly apposite to the subject are the history of the lake dwellings, undertaken fifty years ago, in company with a band of archæologists of which he laments that he is the only survivor, the history of navigation, of fishing, and of pisciculture.

The history of navigation is treated very fully, from the canoe of the lake dweller to the modern steamer, and is illustrated with reproductions of many ancient pictures of ships; with such fulness of detail is the subject treated that we have a list of steamers plying on the lake from the *Guillaume-Tell* of 1823 to those of the present day.

The ancient tradition of the "éboulement du Lauredunum" is discussed in its scientific bearings. The tradition, supported by contemporary chronicles, is that in the year 563 A.D. a mountain was precipitated into the lake, destroying a castle, villages and churches, causing a flooding of the shores of the lake, and much destruction of property and life in Geneva. He shows that a landslip, such as has occurred several times in history, could not account for the production of great floods. Although he has abandoned the belief that earth movements habitually produce seiches, he admits that a great earthquake might be the cause of the land-slide, and coincidentally of a great seiche, which would cause destruction on the shores of the lake. He thinks it more probable, however, that at a time of ordinary flood, when the waters of the lake were very high, an ordinary seiche of no more than a metre of amplitude might cause considerable flooding in Geneva, and perhaps wash away some wooden bridges and houses, the connection with the landslip being a mere coincidence.

In his philosophical reflections at the conclusion of his work, Prof. Forel claims that there have been few problems presented to him in the course of his investigations which he has not been able to solve, and the more difficult of these few are general problems, not belonging to his special province, and the solution of which must be sought in other lakes. He would, however, guard against this assertion being misunderstood as a boastfully complacent assumption that he has exhausted the subject. Every naturalist has his limits, determined from within by the extent of his powers, from without by the state of the